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Title

RIVER DISCHARGE LINES CHARACTERIZATION REPORT

Author

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RIVER DISCHARGE LINES
CHARACTERIZATION REPORT

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SUMMARY

In the early spring of 1984 the deactivated effluent water discharge lines (river lines) for the 100-C, -DR, -F, and -H Areas were radiologically and physically characterized by UNC Decommissioning Services and Suboceanic Consultants, Inc.

The subcontactor located the lines, verified the size, number and position, assessed the condition, and helped provide pipe sections and sediment samples. Decommissioning Health Physics surveyed pipes and analyzed sediment and scraping samples to determine radionuclide inventory, concentration, and activity.

After a late start the project was finished on schedule, cost $74,891, and was done safely and without accident in spite of the dangers associated with underwater diving and cutting.

Two projects are indicated from these results. One project would determine the location, size, and length of all river discharge lines; inspect the remaining river discharge lines (100-B/C, -KE/KW, -D/DR, -F, and -H Areas); and locate the missing 100-F Area segment. Active lines in the 100-N Area could be included in the inspection if deemed necessary. The second project would engineer and then physically remove the lines from the river.

1.0 INTRODUCTION

1.1 PURPOSE

The effluent water discharge lines (river discharge lines) for the Hanford 100-C, -DR, -F, and -H Areas were physically and radiologically characterized in FY 1984, as the first major step in the decommissioning process. Characterization data will be used in the determination of how the discharge lines will be decommissioned. The physical characterization and removal of pipe sections and sediment samples for isotopic analysis were performed by Suboceanic Consultants, Inc. (SCI) on a subcontract basis. The subcontract was administered by the UNC Subcontracts Subsection. UNC Decommissioning Engineering Subsection provided technical direction and radiological characterization support.

1.2 SCOPE

This report will focus on the radiological characterization data. A summary of the physical findings is included in Section 4.0; and the subcontractor report is attached as Appendix A.

The characterization work was limited to the deactivated retention basin discharge lines located in and immediately adjacent to the Columbia River in the 100-C, -DR, -F, and -H Areas. Other discharge lines for 100-B, -D, -KE/KW, and -N are either part of an active or back-up water system. These lines are steel pipe of varying diameters that extend from the outfall structures to the center of the river.

2.0 DESCRIPTION OF DISCHARGE LINES

The following paragraphs generally describe the discharge lines physically and provide radiological characterization data.

2.1 LOCATION

The Hanford 100 Areas are located along the Columbia River at the northern end of the Hanford Site (Figure 1).

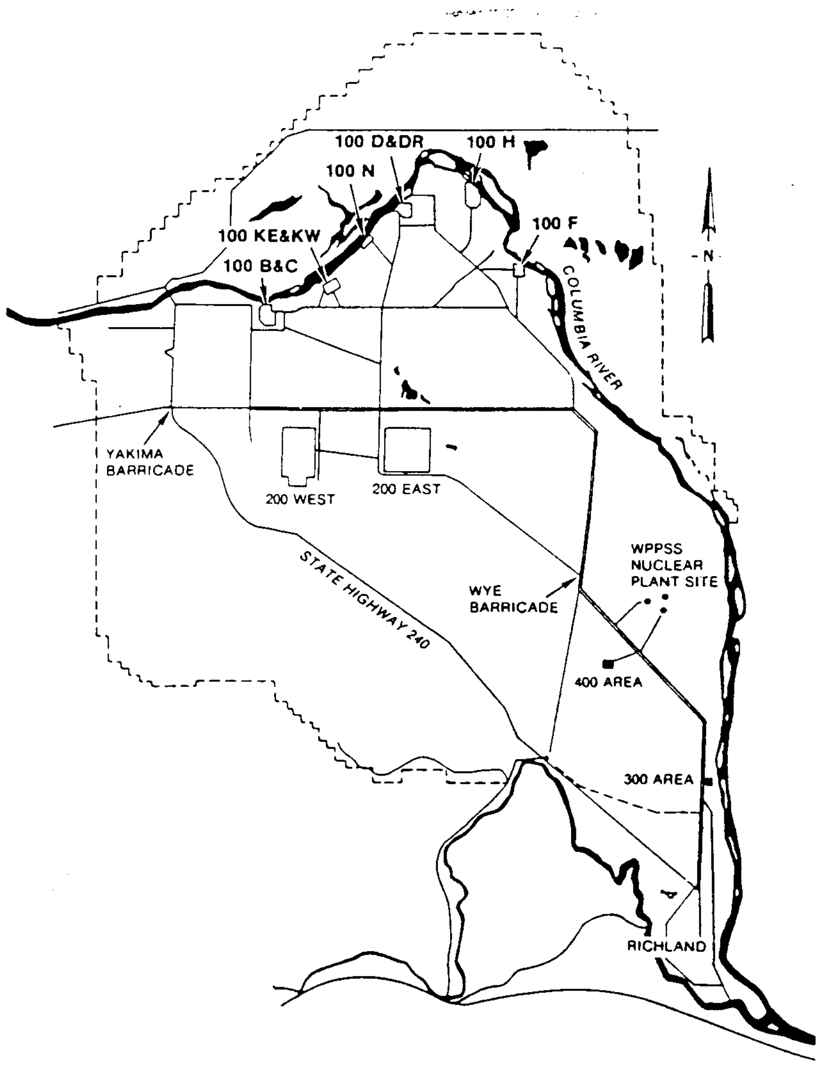


Figure 1. Hanford Site Map.

2.2 OPERATING HISTORY

The river discharge lines were constructed as part of each area's effluent system and operated until the associated reactor was shut down. Table 1 gives the startup and shutdown dates for the four areas addressed.

TABLE 1

RIVER DISCHARGE LINE OPERATING HISTORIES

Reactor Area	Initial Startup Date	Final Shutdown Date	Years Operated
100-C	11/18/52	04/25/69	16
100-DR	10/03/50	12/30/64	14
100-F	02/25/45	06/25/65	20
100-H	10/29/49	04/21/65	15

In the early 1960's the 100-H Area lines were reanchored and reburied after trapped air had floated them out of place.

2.3 PHYSICAL DESCRIPTION

The river discharge lines were part of the reactor effluent systems. Each line extended from an outfall structure to the center of the Columbia River, where it released reactor cooling water which had been held in the retention basin long enough to allow thermal cooling and decay of short-lived radionuclides. Outfalls were open, reinforced concrete structures that directed the water through either the river discharge lines or the spillways. The spillways were concrete flumes used when the river lines were blocked, damaged, or undergoing maintenance. Figure 2 shows a typical 100 Area effluent system.

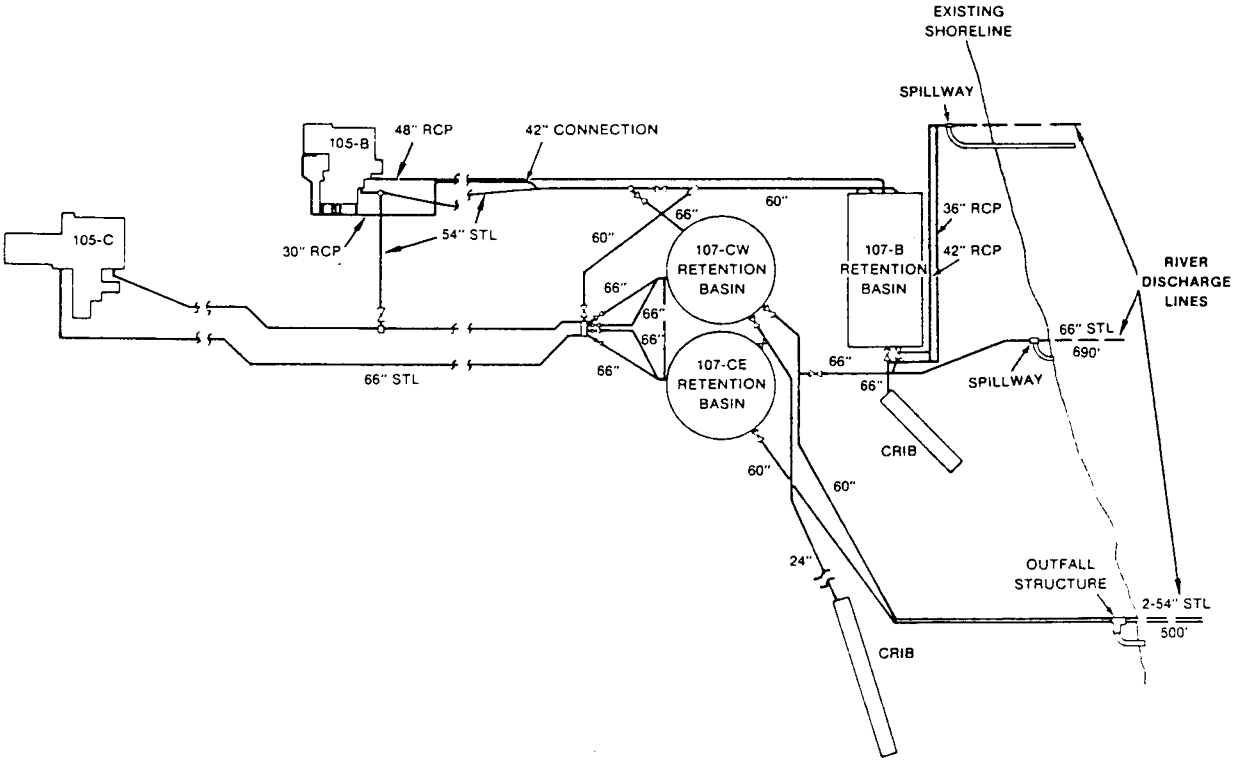


Figure 2. B/C Effluent System (Typical).

All the river discharge lines were constructed of concrete pipe connected to steel pipe of the same diameter. The concrete pipes ran from the outfall structure down to river-bottom level and connected to the steel pipes which continued out the remainder of the distance along the river bottom. Typically a shallow trench was excavated; then the pipe was installed and joined with butt welds, dresser couplings, and ground jumpers. The lines were anchored with poured concrete cones and buried with a minimum of three feet of fill.

The pipes were secured at the outlet with a final anchor and boulder riprap. The mouth of the pipe was modified to a smooth, round lip.

At the 100-DR Area the lines ran underneath an existing island and were vented with small diameter pipe. A recent examination of the vents is discussed in Appendix B.

Table 2 summarizes the physical characteristics that were described on the design drawings for the retention basin discharge lines. The instrumentation and techniques used in the physical characterization are described in Appendix A. Figures 3 and 4 show the setup of equipment on the river to locate and inspect the lines.

TABLE 2

RIVER DISCHARGE LINE PHYSICAL DATA

Area	Pipe Diameter (in.)	No. Lines	Approximate Total Length (ft)	Design Dwg. No.
100-B*	66	1	700	H-1-26050
100-DR	60	1	1800	H-1-9910 DR
100-F	42	2	450	W-72093
100-H	60	2	700	P-4319

*Design drawings for 100-B were cited. Actual work was done on C-Area lines, accounting for the discrepancies stated in the contractor's report.

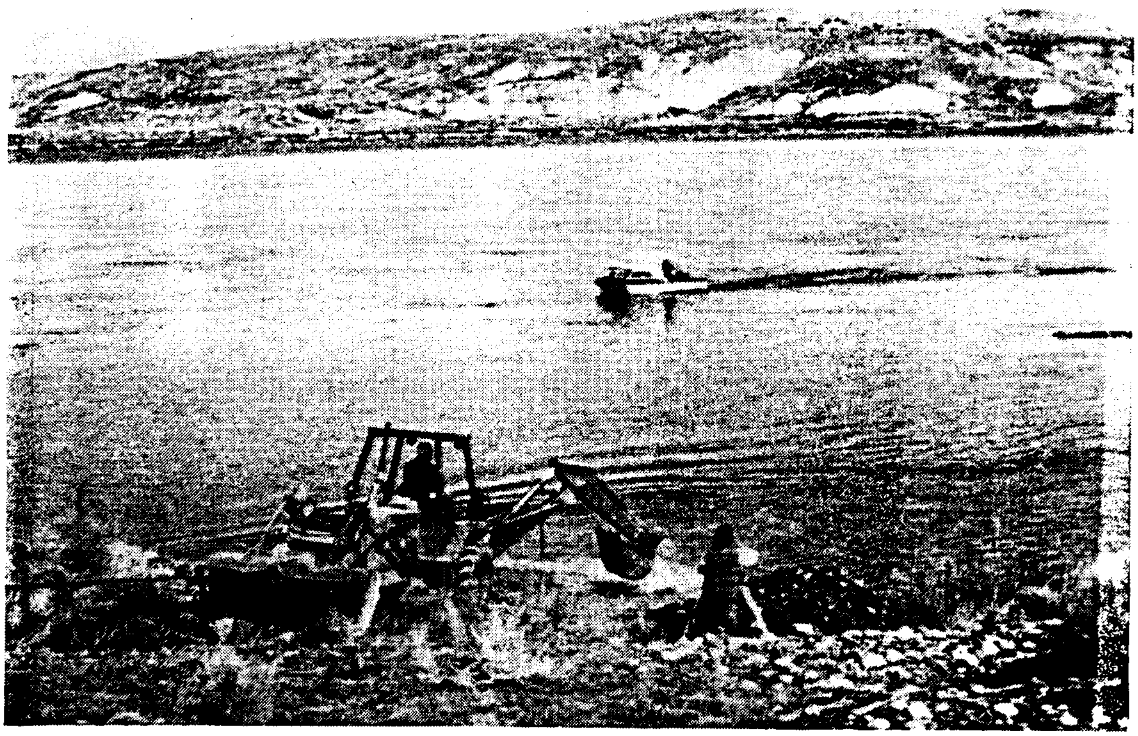


Figure 3. Transit, Backhoe, and Diving Boat while Locating River Lines.

Figure 4. Fathometer Charting Depth Readings along River Line.

3.0 RADIOLOGICAL CONDITION

3.1 SAMPLING METHODS

Radiological characterization consisted of direct and smear surveys of sample pipe sections removed from the river, isotopic analyses of scrapings taken from the interior surface of the sample sections, and isotopic analyses of loose scale removed as sediment from the pipe located near the shore. Pipe sections were removed from a line in each area, except for 100-H, where turbulent conditions prevented the use of heavy equipment and a diver.

All pipe sections were removed near the shore (Figure 5). A backhoe was used to excavate around the pipe. Using underwater oxy-arc cutting electrodes, the diver cut a 100 cm^2 hole in the pipe, took a plastic sample jar of sediment from the low point of the pipe, then cut a large section (approximately 3 ft x 3 ft) from the pipe. The cut section was removed with chains attached to the backhoe (Figures 6 and 7). The excavated area around the pipe was then filled and contoured.

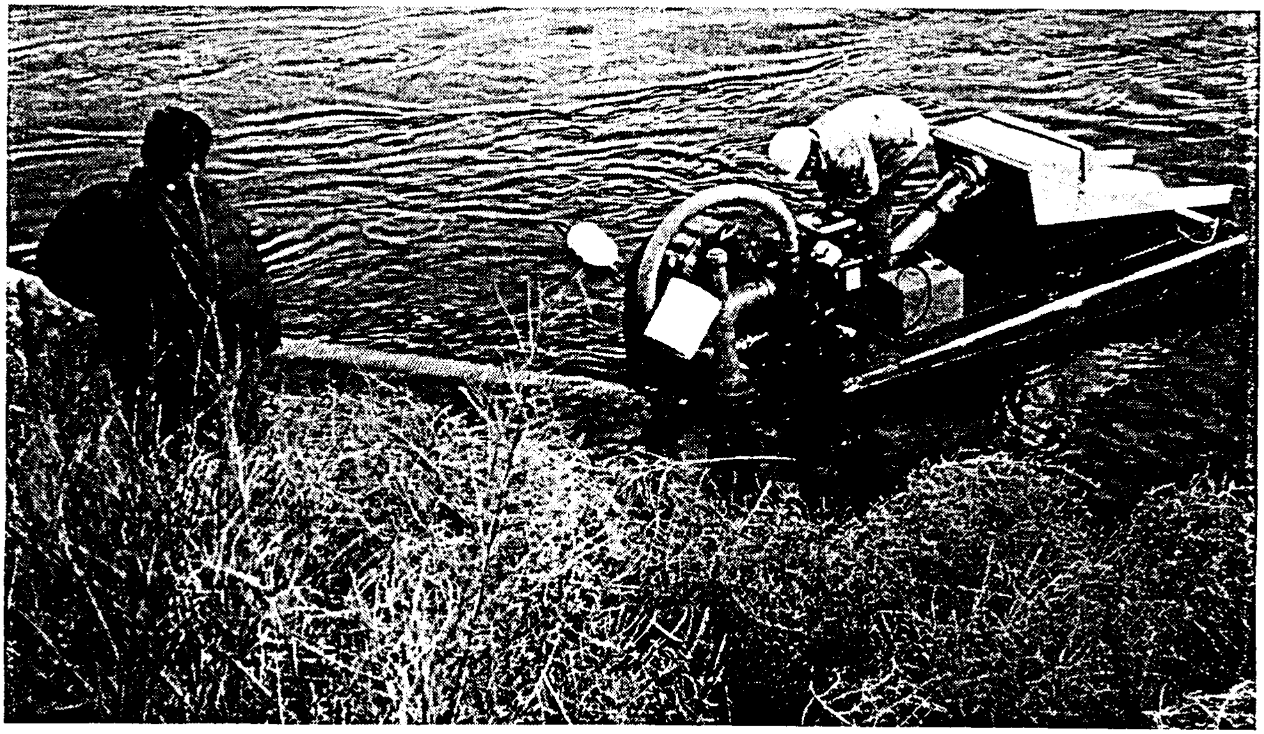


Figure 5. Dredge and Underwater Oxy-arc Cutting Electrode Support Raft.

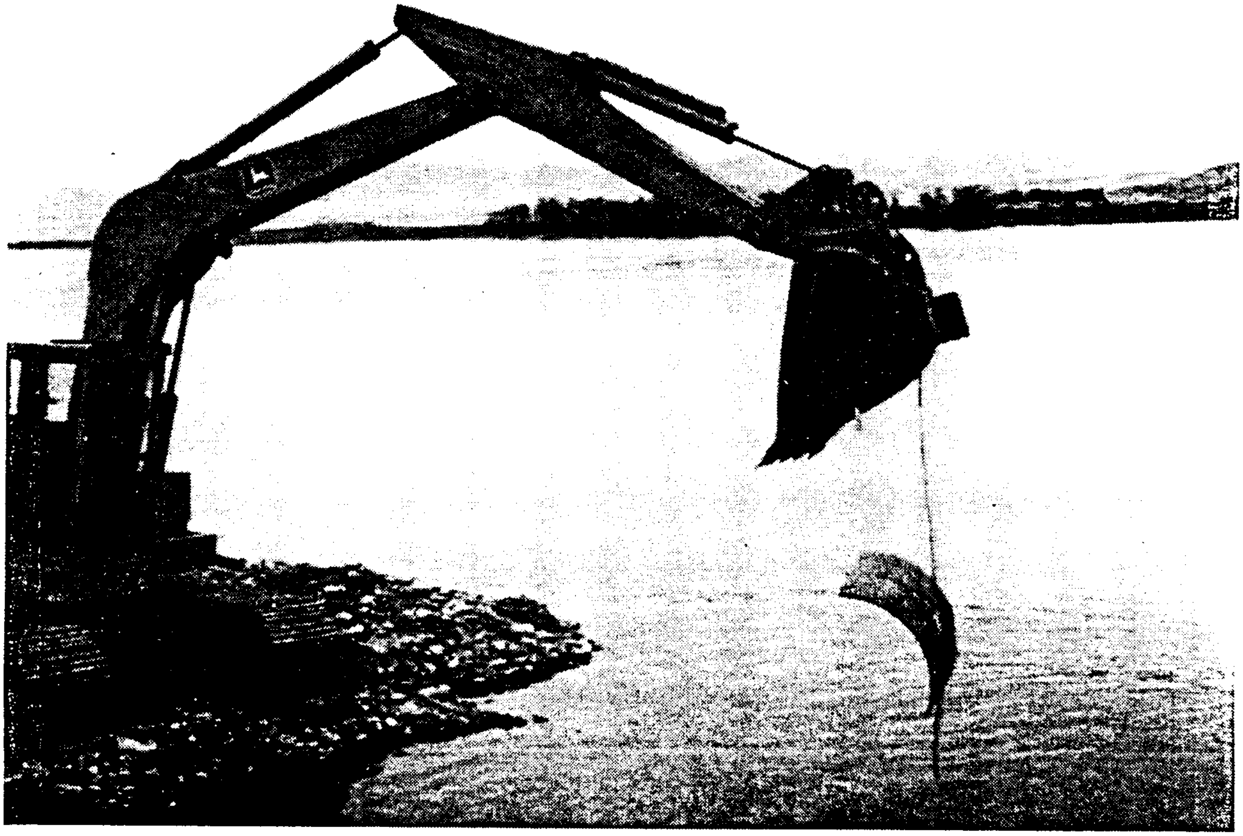


Figure 6. Backhoe Removing Sample Section from River.

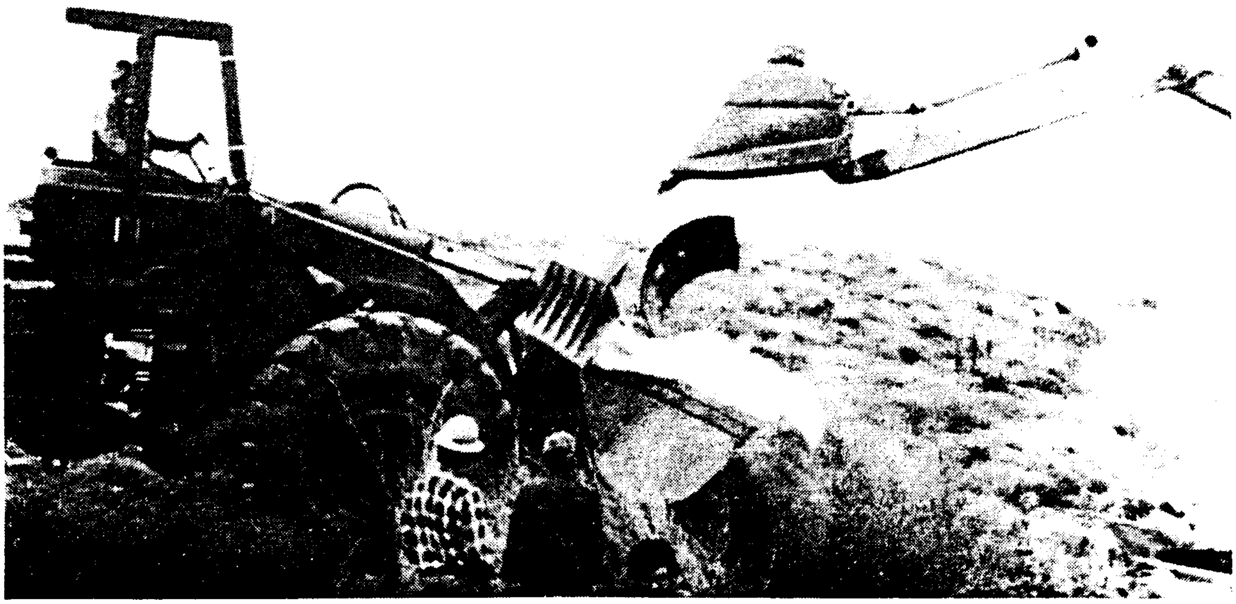


Figure 7. Backhoe Placing Sample in Bucket of Front Loader.

No contamination was found on the exterior surface of any pipe (Figure 8). All identified radioactive material was located on the interior surfaces and in the loose scale (sediment) from inside the inactive pipe. Table 3 lists the instruments used to determine the isotopic concentrations and activities found in the 100-Area river lines. The Model 6700 Multichannel Analyzer's calibration and quality control procedures were conducted in accordance with UNI-M-76 REV1, Effluent Analytical Program. Figure 9 shows the sample section in the front loader as technical smears were taken.

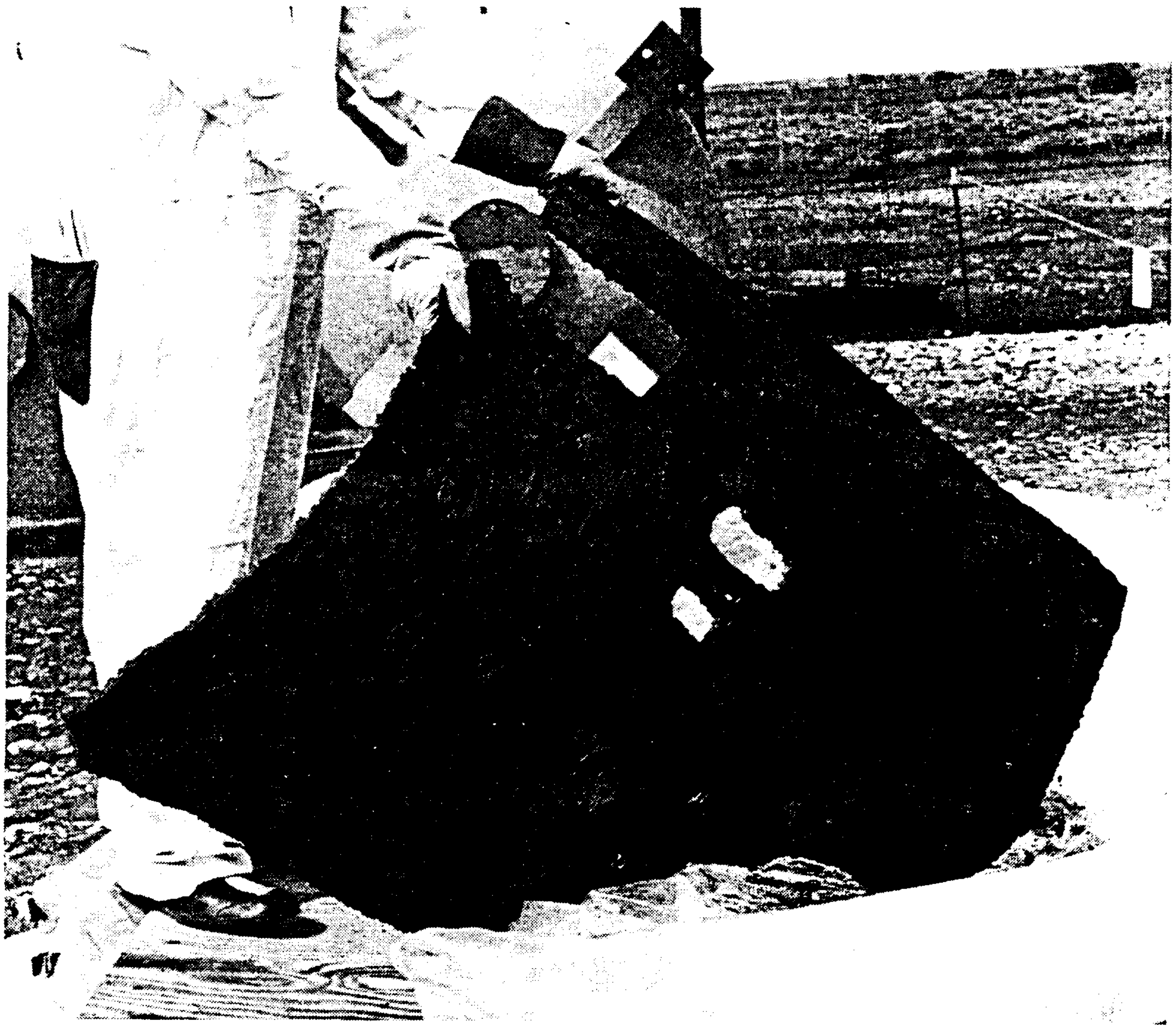


Figure 8. Sample Section Exterior Surface after Removal from River.

TABLE 3

INSTRUMENTATION

Direct readings	Eberline Instrument Corporation Model BNW-1 with P-11 Pancake Probe (12.5 cm^2)
Gross alpha/beta	Canberra 2404 Gas Proportional Counter
Technical Smears	Gamma Products 4000 Gas Proportional Counter
Isotopic Analysis (Gamma)	Nuclear Data Multichannel Analyzer Model 6700 (100-N, Room 50 Lab)

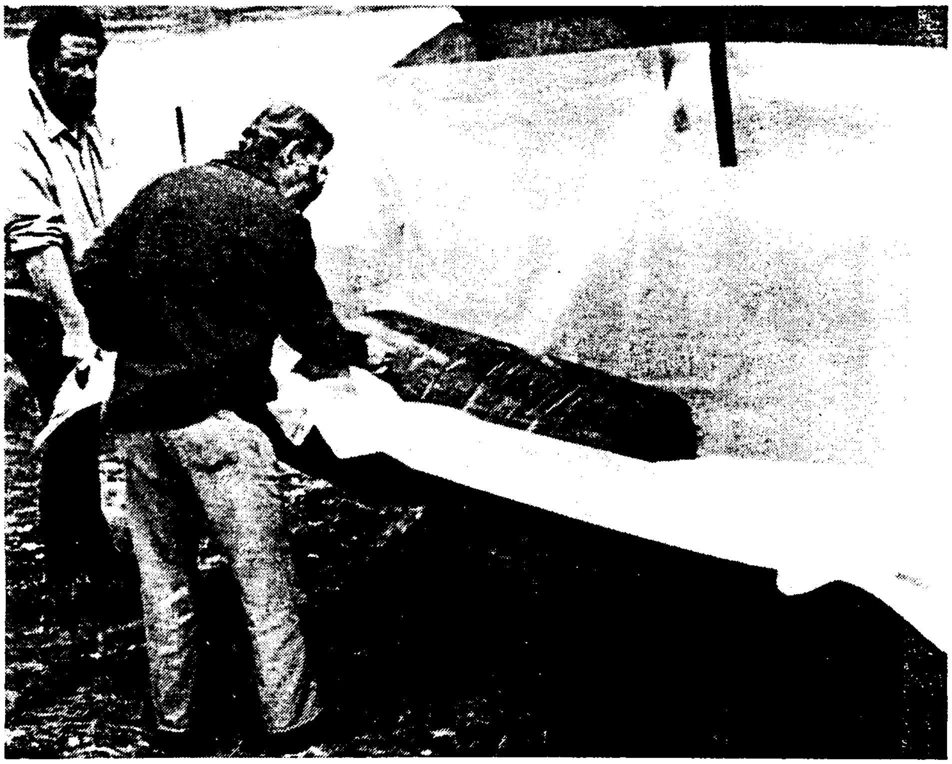


Figure 9. Technical Smears were Taken from Sample Section.

3.2 RADIOLOGICAL CHARACTERIZATION SUMMARY

Prior to sample collection, the river discharge lines could be considered "dead legs", with very little circulation of river water in the pipe. The predominate isotopes in the lines were europium-152 and europium-154. Higher concentrations were found in the scrapings from the inside surface of the pipe samples (Figure 10). For each sample tested, the isotopic concentrations in sediment were less than in the scrapings. Most of the activity seemed to be fixed within the rust on the interior pipe surface, from which the scrapings were collected.

A comparison of the gross beta and alpha counts from scrapings taken from the inside surface of the pipe coupons is shown in Table 4.

Table 5 lists the radiological data from each of the river lines except the line from 100-H Area. Direct beta-gamma readings were made with the standard P-11 probe on the inside surface of the pipe samples. The direct surface readings indicate the activity per probe area, about 12.5 cm^2. Therefore, the direct surface activity per 100 cm^2 would be approximately eight times greater than the number listed on Table 5. The samples were essentially drip-dried when the readings were taken. Technical smears were collected after the pipe samples were sufficiently dry. One technical smear data point per pipe sample was recorded. Based on the technical smears and direct survey data, the contamination in each pipe exceeds the unrestricted release criteria set forth in Table 11-1, UNI-M-31, Environmental Control Manual.

The contact dose rate on the outside pipe surface was zero. The contact dose rate on the interior surface was less than 1 mrem/hr.

A six-inch square coupon was cut from each of the pipe samples, wrapped, and stored. The rest of the pipe sample was disposed of as low-level radioactive waste.

TABLE 5

RIVER LINE CHARACTERIZATION DATA

SITE	SAMPLE	ISOTOPIC ANALYSIS ISOTOPE	ISOTOPIC ANALYSIS pCi/g	ACTIVITY LEVEL (BETA-GAMMA) DIRECT dpm/probe***	ACTIVITY LEVEL (BETA-GAMMA) TECHNICAL SMEAR dpm/100 cm^2
100-C	Pipe section inner surface			33,000	6,700
	Loose scale*	Co-60	150		
		Eu-152	3,400		
		Eu-154	580		
		Eu-155	51		
	Pipe scrapings**	Co-60	600		
		Eu-152	7,700		
		Eu-154	1,300		
		Eu-155	150		
100-DR	Pipe section inner surface			30,000	6,700
	Loose scale	Co-60	150		
		Cs-137	25		
		Eu-152	1,700		
		Eu-154	310		
		Eu-155	16		
	Pipe scrapings	Co-60	670		
		Cs-137	28		
		Eu-152	7,000		
		Eu-154	1,200		
		Eu-155	83		
100-F	Pipe section inner surface			20,000	10,000
	Loose scale	Co-60	120		
		Eu-152	6,500		
		Eu-154	1,000		
		Eu-155	73		
	Pipe scrapings	Co-60	330		
		Eu-152	12,000		
		Eu-154	1,900		
		Eu-155	93		

*Loose scale samples were taken from sediment lying in the underwater pipe.
**Pipe scrapings were taken from the inner surface of the cut pipe section after removal from the river.
***Nominal efficiency for the P-11 Probe used for these results is 10%.

4.0 PHYSICAL CHARACTERIZATION WORK SUMMARY

Physical characterization data (pipe location, length, depth, and condition) were collected by direct visual observation and with electronic instrumentation. The contractor team consisted of a diver and two technicians who used a Garret LT-2000 locator-tracer and a radio-frequency transmitter coupled inductively to the pipes to determine pipe locations and lengths. Depth readings were obtained with a Raytheon fathometer. The subcontractor's full report is attached in Appendix A and includes depth, location data, and drawings. Appendix C is the letter from C. E. Miller to T. E. Dabrowski confirming that no special permits were required from the Army Corps of Engineers to do this project.

100-C River Lines

Both river lines and their anchors are fully exposed and subject to lateral loading, scouring, and undermining caused by river currents.

The lines described are 100-C retention basin discharge lines. The drawing used by the subcontractor was for the 100-B discharge lines, thus explaining the discrepancies.

100-DR River Line

The river line extends from an outfall on the south bank of the Columbia, runs underneath an island, and terminates in a structure in the Columbia, east of the island. Exposed pipe sections between the outfall and the island are subject to lateral loading from river currents. A scour bowl/sediment trap has formed around the terminating structure, causing violent current disturbances. These disturbances seem to be underwater, as a recent inspection of the river surfaces on both sides of the island revealed no swirling or turbulence.

100-F River Lines

Both lines are exposed and subject to lateral loading, scouring, and undermining caused by river currents, which has resulted in missing pipe segments and pipe movement. According to the diver's report, both lines have moved several feet from their original locations. Anchors have moved as well. Because some pipe is covered in sediment, the exact length of missing pipe is not known. The subcontractor made several attempts to look downstream for the missing segments, but determined that neither the available equipment nor the river conditions were adequate to continue.

100-H River Lines

The lines are completely covered; no portions are exposed to river currents. The lines are considered to be structurally stable at this time.

The subcontractor's report mentions an additional pipe trench, pipe segments, and ferrous material in the area detected by instruments but not confirmed by direct observation. The subcontractor was not aware that the 100-H Area lines had been repaired. Further inspection would include an investigation of this area to identify all remaining pipe and remove it, if appropriate.

5.0 COST AND SCHEDULE

The estimated cost for subcontractor work was $30,000. Actual subcontractor cost was $27,352.72. Overall costs, including radiological characterization, engineering and craft support, and administrative overhead, totalled $74,891.

The original schedule called for work to begin in early FY 1984 and to be completed in April 1984. Even though work did not begin until early March because of high river level and flow conditions, the characterization project was completed on schedule.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the conditions found by the subcontractor, the river discharge lines pose no immediate hazard either from a radiological or an industrial safety standpoint. However, according to the subcontractor findings, the current condition of the anchors and loss of cover from the majority of the lines indicate that their removal must be considered. All were initially covered with a minimum of three feet of fill which is now gone in most cases. With the exception of 100-H Area which was repaired, reanchored and covered, all the lines and anchors are suffering from the continuing action of the river which is undermining the anchors and piping and will eventually destroy the stability of the lines, as apparently happened at the 100-F Area. Should a section of piping be dislodged, it could pose a navigational hazard. Additionally, it could pose a slight radiological hazard should someone unfamiliar with its radiological condition try to move it. The contact dose rate of the pipe is very low.

While it is difficult to determine how long the lines will remain stable, based on the diver's observations it is possible to say that eventually the action of the river will totally undermine the piping and supports and they will lose their structural integrity.

The following actions are recommended in two phases:

Phase I

- Research and determine the location, size, and length of all active and inactive discharge lines in the river at each area.

- Inspect all remaining lines in the 100-B/C, -KE/KW, -D/DR, -F, and -H Areas. Active 100-N Area lines could also be inspected for stability if deemed necessary.

- Locate and remove the missing 100-F Area pipe segments.

Phase II

- Engineer the stabilization of active lines or removal of inactive lines from the river as deemed necessary.

- Stabilize or remove the lines.

APPENDIX A

Summary Report of Characterization of Thermal Discharge Pipelines in the Columbia River at 100-F, 100-DR, 100-C, and 100-H

UNI-3262

SUMMARY REPORT

of

CHARACTERIZATION OF THERMAL DISCHARGE PIPELINES IN THE COLUMBIA RIVER AT

100 - F

100 - DR

100 - C

100 - H

prepared for United Nuclear Corp.

by

Innerspace Ventures

September 23,1985

INTRODUCTION & SUMMARY

Investigations were carried out by Suboceanic Consultants Inc., operating under delivery order 003 of contract SA 00113, on the outfall structures located in the decommissioned areas at 100-F, 100-DR, 100-C, and 100-H. These investigations concentrated on locating and characterizing the thermal discharge pipelines of those areas. These investigations were conducted by means of direct observations and remote sensing devices, as well as destructive testing of the pipe walls. Specific attention was given to determine the amount of cover over the pipelines, or the extent of their exposure.

As a result of these investigations, it was determined that three of the areas had pipelines which were not buried, but in fact, were severely exposed. In the case of the F area discharge lines, they showed disconcerting signs of damages of major proportions. The remaining site had not been exposed and was therefore not readily explorable.

F AREA

The F area thermal discharge line drawings indicated a duel 42" diameter steel pipeline system originating at station 1+55 with a tie in to a RCP pipeline on the upland side extending to a control structure. The steel lines were to terminate at station 4+50 with an end structure in river water approximately 20 feet in depth. These drawings further indicated a minimum of 3 feet of cover over the pipeline and a maximum of 5 feet at the tie in juncture.

utilizing a variety of electronic devices, the approximate positions of the two pipelines were marked for pinpointing and depth detecting procedures. A "Garrett" model LT-2000 locator-Tracer electronic probe was then employed to facilitate these tasks. A radio frequency transmitter was inductively coupled to one of the pipes and traced both on land and in the water to it's terminating point. This system also allowed precise depth readings to be obtained electronically. Offshore operations began with bottom surveys conducted with a Raytheon precision survey fathometer. Finally, divers were dispatched to visually characterize the area and confirm data obtained through the remote sensing systems.

The pipeline, as built, consists of two 42" diameter steel pipes originating at approximate station 1+25 under 11 feet of cover. These pipes then sloped down to the water's edge at approximate station 2+00 where they were buried 8 feet deep. From station 2+50 to station 3+50 both pipes were at least partially exposed. This exposure began approximately 50 feet offshore with the top of the pipe armor exposed, and increases to station 3+00 where the entire pipe is exposed. The armour over the pipes consisted of of free form concrete poured in place, and covered the top of the pipes approximately 2" to 6". At station 3+50 the pipelines were undermined 4 to 5 feet. Additionally, there was evidence of pipeline movement at this point and both lines ended abruptly without a terminating structure. Both lines were anchored with precast concrete saddle anchors which had been moved offshore 2 feet, raised up 4 feet, and moved downstream 6 inches. The upstream pipe showed minor damage at the 7 o'clock position, but no other damage was noted on either pipe. This point was marked with a permanent buoy.

This terminating point is approximately 100 LF short of the design drawings indicated terminus. Additional attempts to locate the indicated terminus did in fact reveal some type of structure located at station 4+75 slightly downstream of line. No pipe, evidence of pipe, or trench was found by either the divers or by remote sensing along the alignment of the pipeline. Several attempts to locate possible pipe fragments downstream of the site turned up nothing. These missing pipe fragments can easily be detected with remote sensing devices, however this type of procedure was outside the scope of this investigation and those electronics necessary were not on site for use. At this point it appears that several sections of both pipelines have become dislodged and carried away downstream. The exact extent of the break in continuity cannot be determined at this time. This is in part due to the detection equipment requires a continuous pipeline to act as a R.F. radiating antenna, and partially due to the extreme current velocities. The minimum amount of missing line, as observed by the divers, is 50 LF with a maximum of 125 LF.

The terminating structure lies in a depression bowl approximately 50 feet in diameter and 23 feet deep, and shows an exposure of approximately 2 feet in height.

The final task performed on the F area discharge lines was to excavate and remove a section of the pipe wall for UNC's radiographic characterization. This was accomplished by excavating with a backhoe from the beach and cutting the pipe using oxy-arc underwater cutting electrodes. When the cutting was completed, the diver rigged the sample and the backhoe positioned it at the direction of UNC personnel.

Details of the bathometric surveys and profiles of the existing bottom conditions are included in appendix "A" in a more visual format.

DR AREA

Design specifications of the DR area thermal discharge called for a single 66" diameter steel pipeline which exits the control structure and extends straight into the river for approximately 1800 LF and runs underneath the offshore island. A terminating structure was called for which should be located in approximately 20 feet of water.

The thermal discharge pipeline, as built, consists of a single 66" diameter welded steel pipeline which for all intents and purposes is as indicated on the drawings. Depth of cover over this line varies considerably since the line transects an island. At the line's origin the pipe is overburdened with as much as 30' of cover, while at the shoreline cover is reduced to approximately 8'. Continuing offshore from this point the cover is sporadic and in several areas the pipeline is exposed down to springline. As the line approaches the island it again becomes buried and reaches a maximum depth of 16' under the island. From the island to approximately 50 LF inshore of the terminating structure the pipe remains buried under 2 to 3 feet of cover.

The terminus of the pipeline is exposed as is the terminating structure. Approximately 50 LF of the pipe is fully exposed from the termiating structure back to the first poured in place concrete anchor. The pipe itself remains intact with no signs of movement or damage. The terminating structure has induced a large scour bowl and associated sediment trap. This scour bowl is located with a bottom depth of 17 feet while the associated cliff rises to a depth of only 7 feet. No bar screeds or screens of any kind were present over the end of the pipe and it was silted in with approximately 10" of sediment and river rock. Corrosion rates appear to have been minimal as no loss of section, corrosion holes, or other apparent signs of heavy corrosion activity, or other damages were present. Currents at this location were measured at 22 feet/sec. and are extremely turbulent and violent.

One buoy was placed on the structure for future locating, however, the currents quickly sank it. A second marker was placed in position, but as the currents rose the buoy was pulled under - perhaps never to be seen again.

Finally, a section of the pipe was excavated with a John Deere backhoe and the required sample section cut out by divers using underwater oxy-arc cutting electrodes. This sample was delivered to UNC Radiation Monitoring personnel on site

C AREA

Indications from the as built drawings showed a single 66" diameter welded steel pipeline extending from the overflow control structure offshore some 700 LF and terminating with a concrete structure in water depths of approximately 20'. Additionally three poured in place concrete anchors were called for at approximate stations 2+00, 3+50, and 5+20. The line follows a due north alignment from the structure which was able to be located by still existing construction markers.

As with all of the discharge lines, this pipe was electronically located, pinpointed, and the overburden measured. The offshore surveys were conducted using a precision survey fathometer accurate to within 6" over a 250' depth range. This survey revealed some discrepancies which required direct diver observations to confirm.

Direct diver observations did in fact confirm the results of this remote sensing survey. This thermal discharge system consists of not one but two steel pipes running parallel approximately 5' apart. These lines were buried approximately 5' deep at the shoreline (station 2+30). Immediately offshore of this point (approximately 25' to 30') both of these lines emerge from the river bottom and are exposed along the entire length of the line. At least two poured in place concrete anchors were located with the remote sensing surveys, and the third located during excavation of the sample section. Two sections of the lines were found to be undermined and unsupported for approximately 100 LF, and the majority of the remaining length of the lines were completely exposed. No terminating structures were located either by remote sensing or by direct diver observations, however, both lines are continuous out to their terminating stations.

Direct observations of these lines revealed no signs of externally induced damages, nor appreciable corrosion. The pipeline walls were probed and were found to be solid and uniform in all areas inspected. The terminus of these lines were not directly observed as they were buried,however, the terminus was located with remote sensing and was located at the appropriate station. A marker buoy was placed at this location and appears to be stable in the existing currents. These currents were measured at 12 ft/sec but are fairly laminar in nature.

Finally, the pipe wall sample was cut out by the divers and placed on the shore for utilization by UNC representatives, and the excavation site returned to it's original contours.

H AREA

Plans and specifications indicated that the 100-H area thermal discharge system consisted of two 60" diameter steel pipelines emerging from the overflow control structure and follow an alignment of 71°50' down the riverbank slope to a turning point, and then follow an alignment of 090° true for the remainder of it's length.

Extensive remote sensing surveys were conducted along both of the indicated bearings to locate the precise position of the turning point. These surveys turned up anomalies which were inconsistent with the plans and specifications. Electronic locating, tracing and depth detection confirms that a pipeline does follow the prescribed course and is continuous along its entire length, as evidenced by it's ability to be inductively coupled to the RF tracing probe. This line is completely covered with river sediments along it's entire length to an average depth of 3' to 5'. Additionally, no scour bowl or any signs of pipe trench or other bottom irregularities are located anywhere along this course.

This information, however, conflicts with fathometer surveys conducted on an extension course of N 71°E from the overflow structure. The fathometer record plainly shows some sort of remnant excavated trench extending along this bearing and in several areas there appears to be a single exposed pipe at the bottom of this trench. Additionally, Metal detecting devices showed the presence of ferrous metals in this area, but no inductive couplet was obtainable with the shorebased location.

Neither of these anomalous areas were directly observed. In the one case the river bottom covered all traces while in the other case the river currents were extremely high. The timing of the investigations in this area coincided with high river water and strong currents. The high water conditions also precluded the placement of our heavy excavating equipment on the site of the pipe, and therefore no pipe wall sample was obtained. At the direction of the UNC representative on site, all further investigations at this site were terminated due to the extended time that the river would be running high. Based on the remote sensing data, it appears that the entire pipeline, as shown on the construction plans, is buried between 5' and 18' deep and is therefore unavailable for direct observation.

CONCLUSIONS AND RECOMMENDATIONS

Several conclusions on the characterization of these four thermal discharge systems are inescapable. These are:

1. The F area pipelines are completely exposed to the force of the river flow and the stresses induced by that flow. Either these stresses or other induced forces have dislodged both pipelines from their foundations and carried away several sections of each pipeline.

2. The DR area Discharge lines are completely exposed to the river flow in areas inshore of the island. Although no large sections of the pipe offshore of the island are exposed, the scour bowl/sediment trap discontinuity induces extremely violent current disturbances which are definite hazards to navigation in the immediate area. Those exposed sections inshore of the island, are not subjected to the high mainstream currents and therefore do not present as great a hazard. However, this area of pipe is subject to lateral loading induced by the river's currents.

3. Both discharge lines located in the C area are fully exposed to the river's full currents and are therefore subject to lateral loading, scouring, and undermining actions which may lead to a loss of structural continuity.

4. The H area pipeline is nowhere exposed to the river flow and is therefore structurally stable in it's present environment.

5. Should further investigations be undertaken, it is strongly recommended that such investigations be conducted from heavy floating equipment where a diver can be placed in the water in a crane bucket and maneuvered from the surface. Our investigations were aided by an unprecedented reduction of river flow which cannot be counted on again to facilitate lightweight surface support craft. Any further attempts to free dive in areas which may require additional surveys would be tricky at best and in the case of the DR area quite inadvisable.

UNI-3262

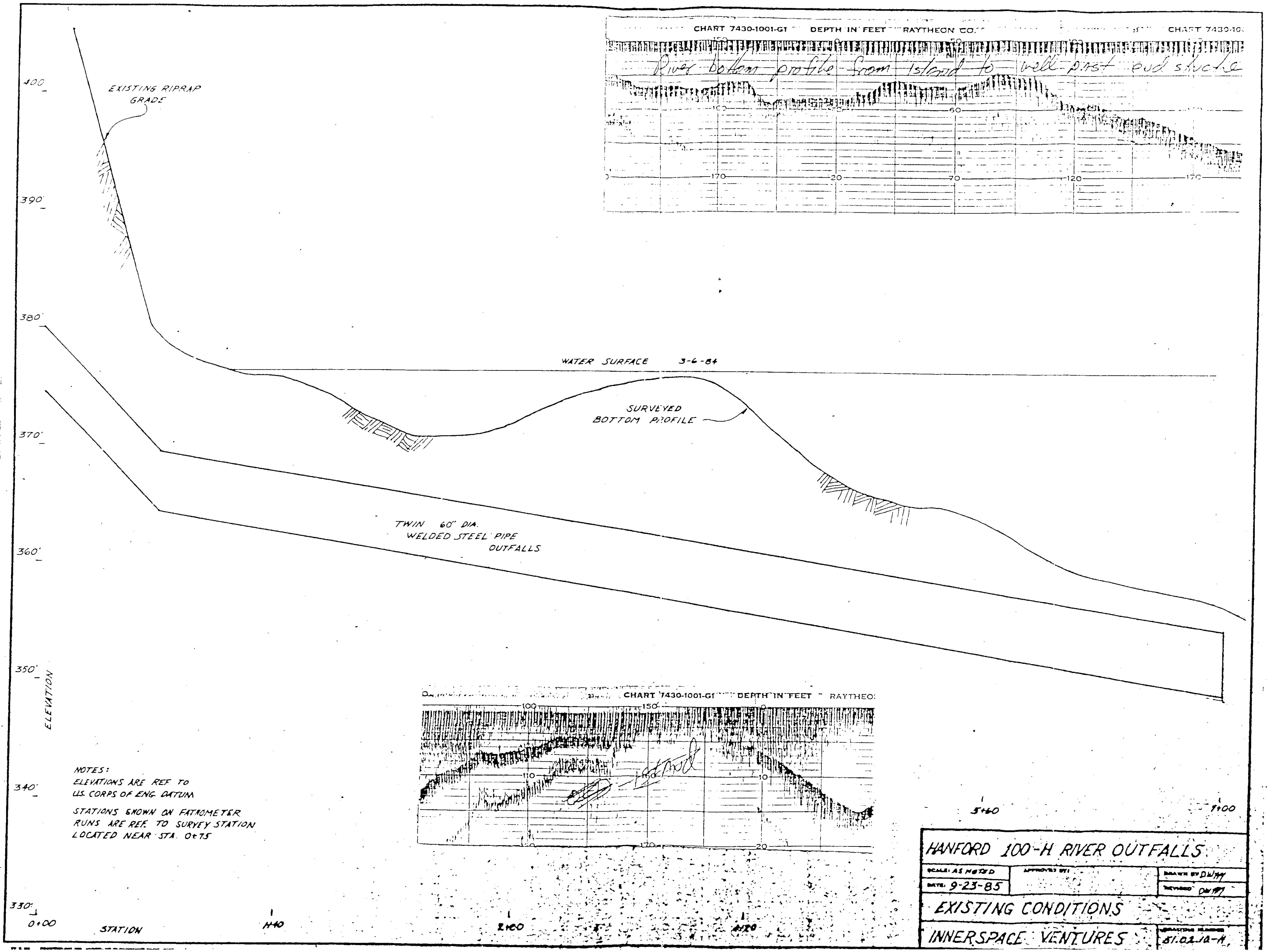
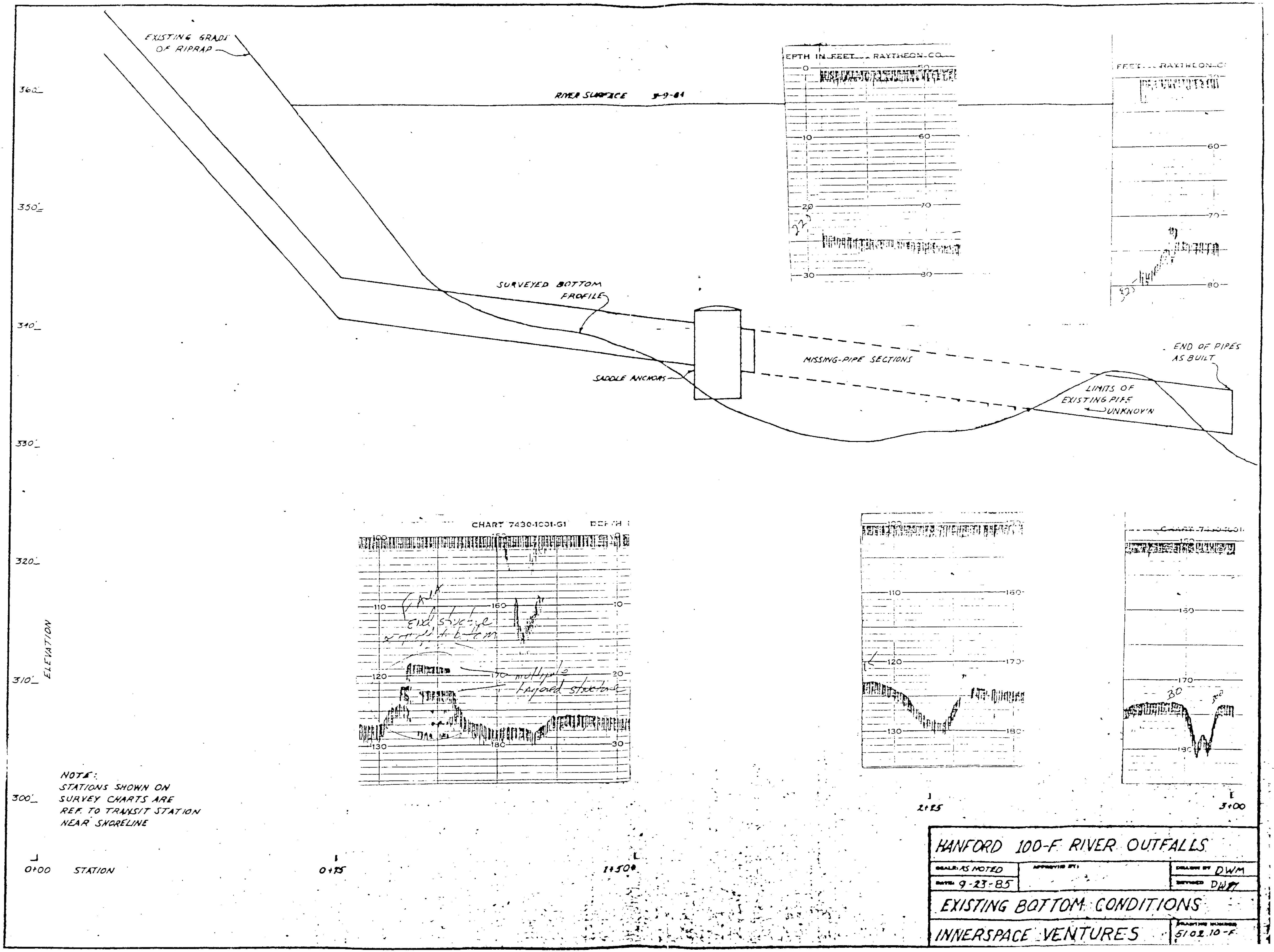
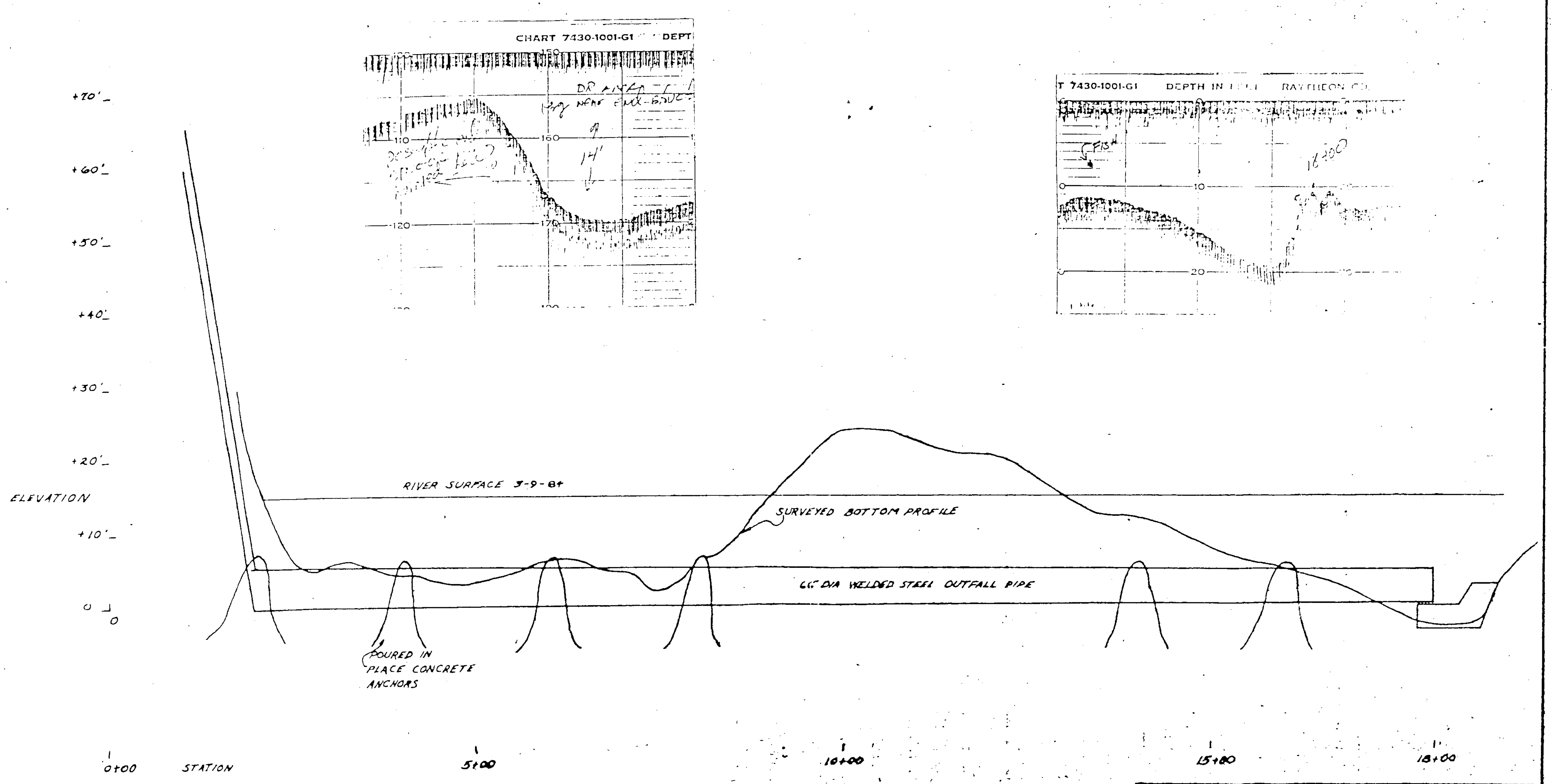


CHART 7430-1001-G1 DEPTH IN FEET RAYTHEON CO.
River bottom profile from Island to well past end structure
EXISTING RIPRAP GRADE
WATER SURFACE 3-6-84
SURVEYED BOTTOM PROFILE
TWIN 60" DIA. WELDED STEEL PIPE OUTFALLS
ELEVATION
400'
390'
380'
370'
360'
350'
340'
330'
NOTES:
ELEVATIONS ARE REF. TO U.S. CORPS OF ENG. DATUM
STATIONS SHOWN ON FATHOMETER RUNS ARE REF. TO SURVEY STATION LOCATED NEAR STA. 0+75
STATION
0+00
1+40
2+80
5+60
7+00
CHART 7430-1001-G1 DEPTH IN FEET RAYTHEON
HANFORD 100-H RIVER OUTFALLS
SCALE: AS NOTED
APPROVED BY:
DRAWN BY DW/PJ
DATE: 9-23-85
REVISED DW/PJ
EXISTING CONDITIONS
INNERSPACE VENTURES
81.02.10-A

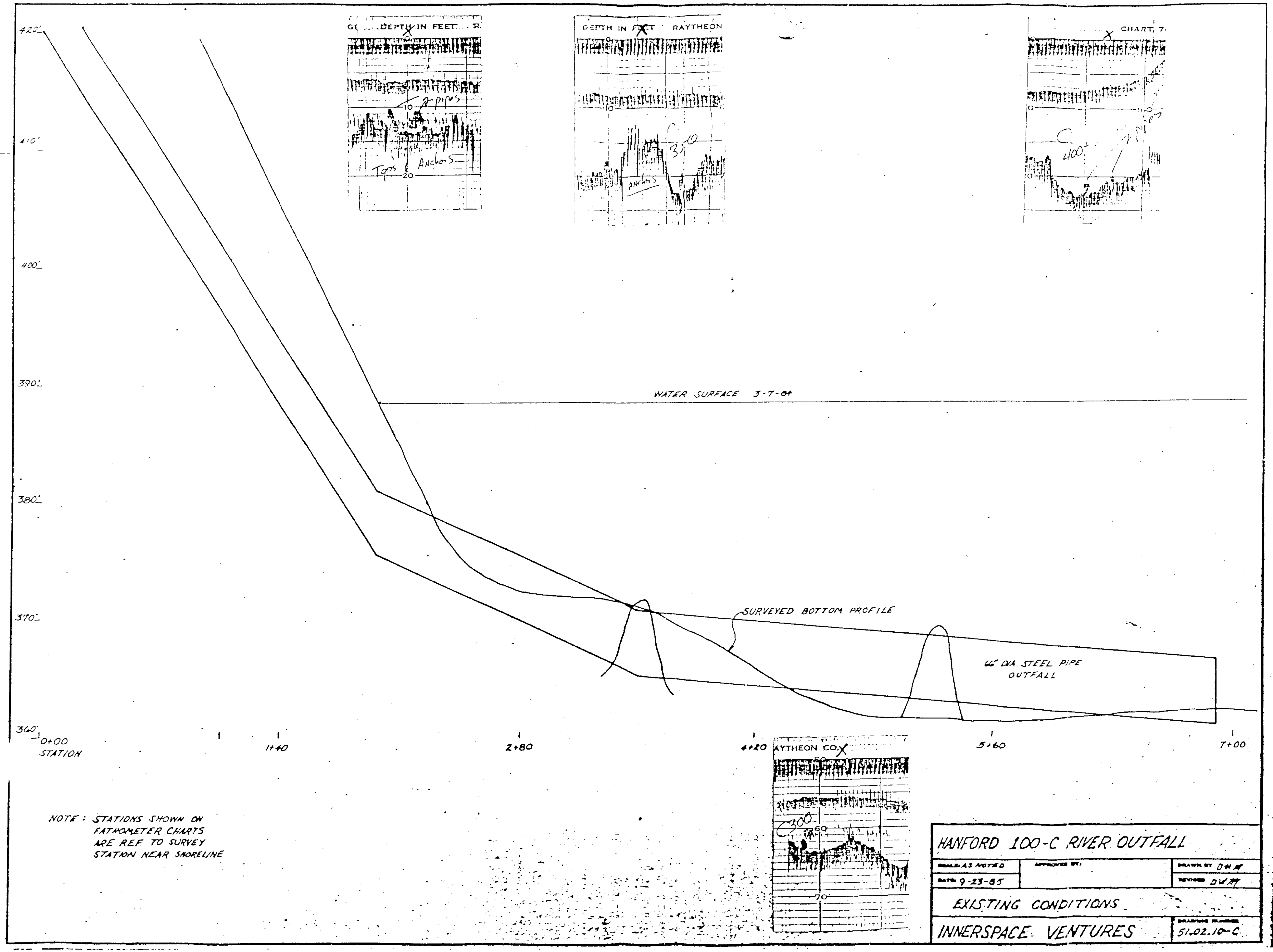

EXISTING GRADE OF RIPRAP
RIVER SURFACE 9-9-84
SURVEYED BOTTOM PROFILE
SADDLE ANCHORS
MISSING-PIPE SECTIONS
END OF PIPES AS BUILT
LIMITS OF EXISTING PIPE UNKNOWN
360
350
340
330
320
310
300
ELEVATION
CHART 7430-1001-G1
DEPTH IN FEET RAYTHEON CO.
multiple layered structure
NOTE: STATIONS SHOWN ON SURVEY CHARTS ARE REF. TO TRANSIT STATION NEAR SHORELINE
0+00 STATION
0+75
1+50
2+25
3+00
HANFORD 100-F RIVER OUTFALLS
SCALE: AS NOTED
DATE: 9-23-85
DRAWN BY DWM
EXISTING BOTTOM CONDITIONS
INNERSPACE VENTURES
5102.10-F



NOTES:
ELEVATIONS ARE REF TO PIPELINE INVERT DATUM

STATIONS REF ON CHARTS ARE FROM TRANSIT STATION NEAR SHORE LINE

HANFORD 100-DR RIVER OUTFALL		
SCALE: AS NOTED	APPROVED BY:	DRAWN BY: DWM
DATE: 9-23-85		REVISED:
EXISTING BOTTOM PROFILE		
INNERSPACE VENTURES		DRAWING NUMBER: 51-02.10-DR



420'
410'
400'
390'
380'
370'
360'
0+00
STATION
1+40
2+80
4+20
5+60
7+00
DEPTH IN FEET
RAYTHEON
CHART
pipes
Tops
Anchors
Anchors
WATER SURFACE 3-7-84
SURVEYED BOTTOM PROFILE
66" DIA. STEEL PIPE
OUTFALL
RAYTHEON CO.
NOTE: STATIONS SHOWN ON
FATHOMETER CHARTS
ARE REF. TO SURVEY
STATION NEAR SHORELINE
HANFORD 100-C RIVER OUTFALL
SCALE: AS NOTED
DATE 9-23-85
DRAWN BY DWM
EXISTING CONDITIONS
INNERSPACE VENTURES
51.02.10-C

APPENDIX B

1. "Radiological Survey of 'D' Island" from <u>Radiological Survey of Exposed Shorelines and Islands of the Columbia River Between Vernita and the Snake River Confluence</u>, April 1980, by M. J. Sula for Pacific Northwest Laboratory, PNL-3127/UC41

RADIOLOGICAL SURVEY OF "D" ISLAND[a]

A survey of "D" Island was performed on October 25, 1978 to determine its current radiological status. Some of the results of the survey were higher than had been expected, and a resurvey was conducted on October 30, 1978, to determine the distribution and density of the radioactive particles, to take exposure readings more amenable to interpretation, and to collect several particles for radionuclide identification and quantification.

The water level of the river at the start of the resurvey (October 30) was 381 feet at D Reactor water intake. This was approximately the same as the level at the start of the October 25 survey, although no gauge reading was taken during the October 25 survey.

The shore of "D" Island is characterized by a surface covering of smooth rocks 1 to 6 inches in diameter over a layer of mixed pea gravel to sandy-silty material. Three of the most radioactive particles that could be found were found in the top 1/4 to 1/2 inch of the pea gravel/sandy-silty layer. The microscopic particles could not be differentiated from the matrix in which they were found except by the radiation they emitted. Laboratory analysis of the particles using a GeLi detector and a multichannel analyzer showed that the particles were 100% ^{60}Co. No trace of any other radionuclide was observed, confirming that the particles are not of recent origin. Activities of 2.8 to 22 μCi ^{60}Co were measured on these particles.

Most of the radioactive particles located had contact exposure rates of 50 to 150 μR/hr. At a distance of one meter exposure rates of background (6-8 μR/hr) to 13 μR/hr were noted for most particles. A small fraction of the particles, perhaps 1 or 2% contained more activity and exhibited exposure rates up to 60 μR/hr at one meter. One particle was found that read about 750 μR/hr at one meter, but was not recovered due to the rapidly rising water late in the morning. Based on the two surveys, it is estimated that the average radioactive particle on the island contains about 0.5 μCi ^{60}Co.

To gain some information on the distribution and density of the radioactive particles on the island, fourteen, 100 ft^2 areas were selected at random along the north shore, some near the water line and some twenty to thirty feet inland. Each plot was carefully surveyed, noting the number of particles and the contact exposure rate of each particle. A tota of seven particles were located in the 14 areas, yielding a density of 5 X 10^{-3} particles per square foot.

The island is about 2000 feet in length and has an estimated shoreline perimeter of 5000 feet. The wetted area or area where particles may have been deposited in the past and that may be exposed during low flow periods is estimated to average 30 ft in width. Thus, the total number of radioactive particles exposed on the shore during low river flow is estimated to be about 750 (.005 x 5000 x 30). An upper limit estimate of the total activity associated with all the particles on the island is 1000 μCi. This corresponds to an average shoreline surface concentration of about 0.06 μCi/m^2, which agrees reasonably well with the E.G.G. aerial survey of 1973.

In general, background exposure rates at one meter over the shoreline are 6 to 8 μR/hr. Above the radioactive particles are small areas that exceed background, ranging in size from a few inches in diameter at contact to a foot or two in diameter at a meter above the surface.

In addition to the discrete particles, elevated radiation levels were found at vent pipes that penetrate the D and DR Reactor cooling water discharge lines at the upstream end of the island. These are small diameter pipes extending several feet above the surface with a "T" on top and are only visible during low river flow conditions. Contact exposure rates on these vents are 80 to 100 μR/hr.

(a) Letter from J. R. Houston, Environmental Evaluations, Occupational and Environmental Protection Department, Pacific Northwest Laboratory, Richland, WA, to P. F. X. Dunigan, Safety and Environmental Protection Division, U.S. Department of Energy, Richland Operations Office, Richland, WA, "Radiological Survey of "D" Island, Dated November 1, 1978.

APPENDIX C

"Excavation of Small Section of 107-River Discharge Lines for Characterization," Letter from C. E. Miller, DOE-RL, to T. E. Dabrowski, Decommissioning Programs, February 13, 1984.

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

FEB 13 1984

Mr. Thomas E. Dabrowski
Director
Decommissioning Programs
UNC Nuclear Industries
Operations Division
Richland, Washington

Dear Mr. Dabrowski:

EXCAVATION OF SMALL SECTION OF 107-RIVER DISCHARGE LINES FOR CHARACTERIZATION

This confirms the discussion between our respective staffs (Jack Collins and Jim Irish) that no special permits are required to perform the scheduled characterization studies of the 107-F, H, and D/DR river discharge lines. The planned work involves excavation of a small section of the three lines which would allow an approximately three-foot section of each line to be removed for radiological characterization. The lines are 42", 60" and 66" respectively, and the excavation would be underwater but near the shore line.

Mr. Irish had inquired through the RL Program Office whether any special permits were required from the Army Corp of Engineers to do this work. RL-SQA (Ted Austin) has confirmed with the Corp of Engineers that a special permit is not required for this limited work.

UNC should keep this office informed of planned work (significant tasks) and of unexpected problems which arise.

Very truly yours,

Clarence E. Miller, Jr.

Clarence E. Miller, Jr., Director
Surplus Facilities Management
Program Office

SFMPO:JPC